Geophysical Research Abstracts
Vol. 12, EGU2010-1595, 2010
EGU General Assembly 2010

High-Resolution Geoid-Derived Groundwater Storage Changes in Alaska, U.S.A. and Yukon Territory, Canada, from 1999 through 2009 with Comparison to GRACE

Reginald Muskett

University of Alaska Fairbanks, Geophysical Institute, Fairbanks, Alaska, United States (reginald.muskett@gmail.com, 907 474-2691)

Permafrost and talik (earth material within permafrost whose temperature is above the freezing point of water) in Arctic watersheds have significant effects on surface and groundwater hydrology. We investigate water equivalent mass changes in Alaska, U.S.A. and western Yukon Territory, Canada, using high-resolution geoid models to derive net water equivalent changes from 1999 through 2009 and GRACE monthly water equivalent changes, snow water equivalent and watershed runoff from August 2002 through December 2008. High-resolution geoid difference-derived water equivalent mass changes show increases in groundwater storage in the northern Arctic coastal plain of 2.95 $\pm$ 1.97 km^3/a (area-average 2.83 $\pm$ 1.89 cm/a) and decreases in groundwater storage in the Yukon River watershed of 7.06 $\pm$ 1.04 km^3/a (area-average 0.78 $\pm$ 0.11 cm/a) from 1999 through 2009. This compares well with GRACE-derived water equivalent mass changes indicating the Arctic coastal plain groundwater storage (including wetland bog, thaw pond and lake) gain of 1.15 $\pm$ 0.65 km^3/a (area-average 1.10 $\pm$ 0.62 cm/a), and Yukon River watershed groundwater storage loss of 7.44 $\pm$ 3.76 km^3/a (area-average 0.79 $\pm$ 0.40 cm/a) from August 2002 through December 2008. We hypothesize these changes are linked to the development of new predominately closed- and possibly open-taliks in the continuous permafrost zone under thaw lakes with increases of thaw bogs, ponds and lakes and new predominately open-taliks and reduction of permafrost extent in the discontinuous and sporadic zones with decreases of thaw bogs, ponds and lakes of Alaska and western Yukon.